

## Spatial models for the distribution of *Culicoides* on a local scale

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# Spatial models for the distribution of *Culicoides* on a local scale

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$$P_{RG} = \frac{AP+Sp-1}{Se+Sp-1} \int_a^b \varepsilon \Theta^{\sqrt{17}} + \Omega \int \delta e^{i\pi} = \{2.7182818284\}$$

$\infty$   $\chi^2$   $\Sigma$   $!$   $\gg$   $\approx$

# Introduction

Bluetongue virus in Northern Europe

- Infects ruminants
- Vector-borne

*Culicoides obsoletus* group

*Culicoides pulicaris* group



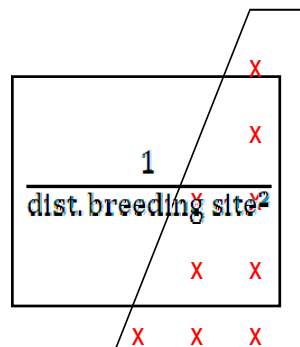
## Objectives

- Model vector dispersal → spread of virus
- First step: Where are the vectors?  
→ (Spatial) factors for vector density?
- Spatial prediction model
- Density measure: Light trap

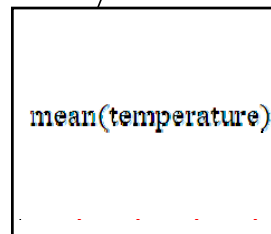
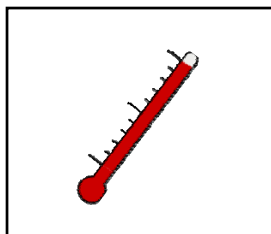
## Study design

- 50 light traps – 50 m grid

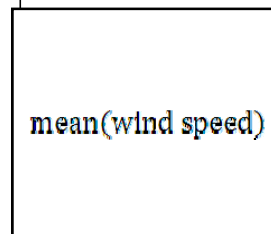
- Dist. to Breeding sites



- Temperature



- Wind speed



# Study design

- Scent of host animals



$$\frac{\text{wind speed} * \text{wind effect} * 1}{1 + \text{dist. sheep}^2}$$

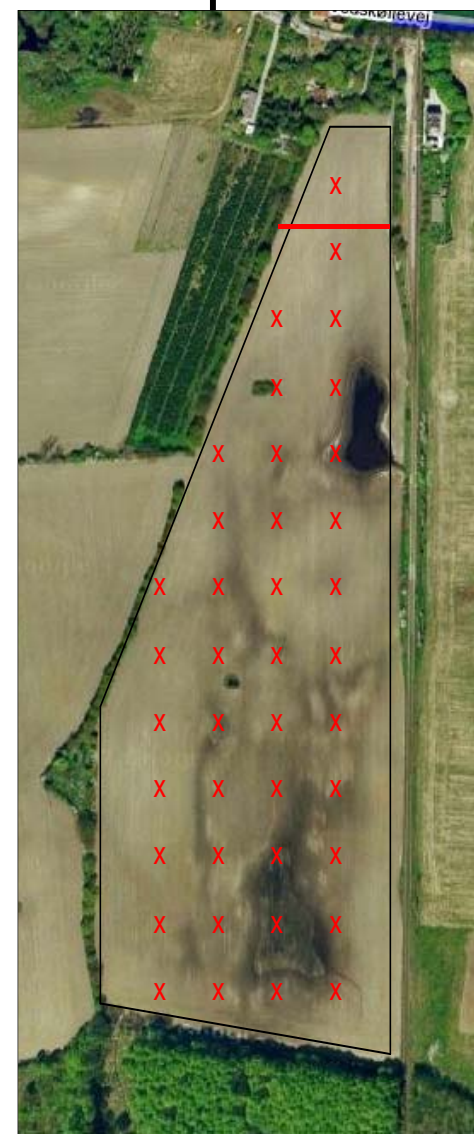
- Windbreaks



$$\frac{\text{wind effect} * 1}{1 + \text{dist. windbreak}}$$

- Interactions:

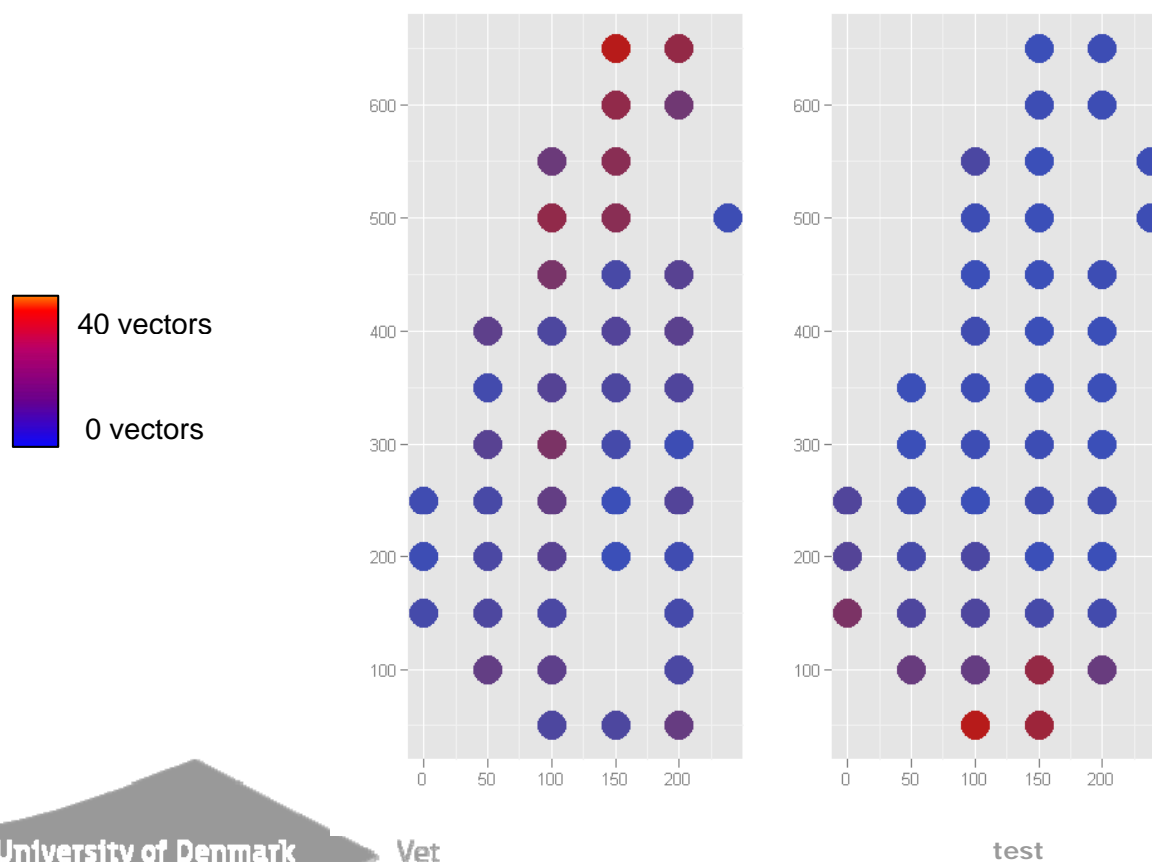
Host animals \* Windbreaks  
Wind speed \* Windbreaks,  
Temperature<sup>2</sup>



# Dataset

Analysis of 8 days: 5180 female vectors

Day	A	B	C	D	E	F	G	H	Total
<i>C. obsoletus</i>	316	259	612	2	93	95	29	253	1659
<i>C. pulicaris</i>	1524	335	952	4	190	223	33	260	3521



## Dataset

- Temperature: 12 – 20°C
- Wind speeds: 0.2 – 3.3 m/s

## Procedures

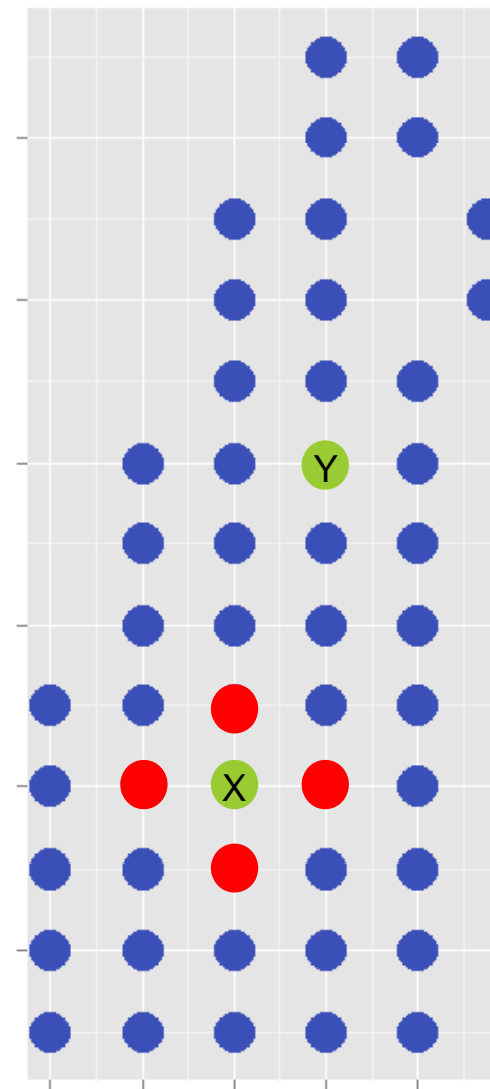
- Normalize data
- Random effect → Mixed Effects Model
- Observations not independent...



## Data analysis

Spatial correlation

- *All information on the surroundings for a trap is contained within the neighbors*
- $X \perp\!\!\!\perp Y \mid \text{Neighbors}$
- $\text{Corr}(X, \text{Neighbor}) = \rho$



## Final model

- *C. pulicaris* estimates

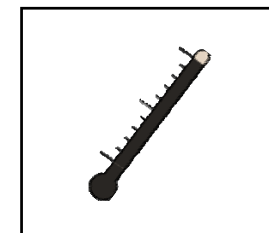
Wind speed: -0.56

Windbreaks: 2.34

Wind speed : Windbreaks : -1.19

(adjusted for spatial correlation)

- *Spatial correlation coefficient,  $\rho = 0.26^{***}$*



N.S.

N.S.

N.S.

## Final model

- *C. obsoletus* estimates

Wind speed: -0.59

N.S.

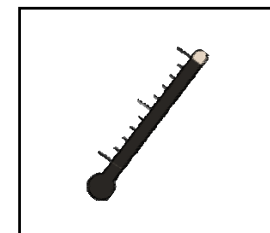
(adjusted for spatial correlation)

N.S.

- *Spatial correlation coefficient,  $\rho = 0.33$*   
\*\*\*

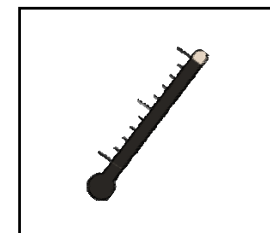
N.S.

N.S.



## Conclusions

- Temperature not significant
- Breeding sites not significant
- Host animals not significant
- Windbreaks significant for *C. pulicaris*
- Wind speed significant



## Current research

- Optimized autocorrelation
- More covariates:
  - Precipitation
  - Turbulence
  - Moisture
- More catch days





**Thank you  
for your attention**

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